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ABSTRACT

Discussed are the effects that cognitive level of teachers' questions and questioning strategies may have on student achievement. Thirty-two preservice elementary teachers were stratified by the grade they were teaching, either primary (grades 1-3) or intermediate (4-5), and randomly assigned to treatments. Treatment levels consisted of mini-lessons in which questions were asked as follows: only high-level questions, only low-level questions, or a mixture of high and low questions. Questioning strategy was either multiple response questioning, in which the same question was redirected to a number of students, or single response questioning, in which only one response was accepted before asking the next question. Results indicate no significant difference among the three treatment levels on any of the criterion measures, but that redirecting questions is an effective strategy when working with small groups of children. It is further implied that the potency of redirected questioning diminishes as the cognitive demand of questions increases. (CS)

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# THE EFFECTS OF PRESERVICE TEACHER'S COGNITIVE QUESTIONING LEVEL AND REDIRECTING ON STUDENT ACHIEVEMENT

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THE EFFECTS OF PRESERVICE TEACHER'S COGNITIVE QUESTIONING LEVEL AND REDIRECTING ON STUDENT ACHIEVEMENT

## Introduction

Research on whether a significant relationship exists between the cognitive level of teacher's questions and any resultant student behavior is surprisingly sparse (Gall, 1970; Ryan, 1973). In a report to the National Institute of Education, Winne (1975) was able to find only eight experimental studies investigating this relationship. Of these eight studies, five were judged by Winne to be either invalid or contributing little to knowledge about the effects of teacher questions on student achievement. Results of two of the three remaining studies (Buggey, 1971; Savage, 1972) are germane to the problem being investigated. The third study (Tyler, 1971) evaluated differences between oral and written questions.

Buggey found that higher cognitive questions led to improved achievement compared to lower cognitive questions in a second grade social studies class. Savage (1972) replicated Buggey's study in a fifth grade classroom but was unable to find significant differences in student achievement. It was suggested that pupil's thought at the fifth grade level is not as dependent upon the teacher's style of questioning. Ryan (1974) indicated that Multiple student responses may have a positive effect on student achievement. Multiple student responses refers to a questioning strategy in which the teacher redirects questions to more than one student.

## Problem

Does the cognitive level of teachers' questions and redirection of questions have an effect on student achievement?

## Sample

The design of this study required a two step sampling procedure:

1. Thirty-two preservice teachers were stratified by the grade they were teaching, either primary (1-3) or intermediate (4-5), and randomly assigned to treatments.

2. The preservice teachers randomly selected five students from their assigned classrooms. This procedure resulted in an n of 160. Data were collected on 154 subjects.

## Treatments

Subjects experienced one of the following treatment levels:

1. High Questions level -- Subjects in this group were taught from a prepared lesson script containing questions judged to be above the knowledge level. The lesson was based on the time and location mini-lesson taken from the Teaching Improvement Kit (Popham, 1972). These kits contain mini-lessons containing an explicit, measurable objective suitable for a 15 minute lesson.

2. Low Questions level -- Subjects in this group were taught from a prepared script containing questions judged to be at the knowledge level of Bloom's Taxonomy (1956). The content for this lesson was based on the same Teaching Improvement Kit mini-lesson used in treatment level one.

3. Mixed Questions level -- Subjects in this group were taught from a prepared script containing 50% questions judged to be above the knowledge level and 50% questions judged to be at the knowledge level. Again the lesson was based on the same mini-lesson as the other two levels.

The subjects also experienced one of two questioning strategies. The first strategy is called multiple response questioning and refers to soliciting multiple student responses by redirecting the same question to a number of students (in this case 2). The second strategy is termed single response questioning and refers to the teacher accepting only one response before asking the next question.

## Criterion Instruments

Achievement test -- This test was comprised of a total of twenty-nine questions. Fifteen of the questions were taken from the posttest provided

with the Popham Teaching Improvement Kit. These questions were judged by a panel of experts to be measuring at the comprehension level of Bloom's Taxonomy. Fourteen additional items were constructed by the author. Ten of these items were judged to be testing at the knowledge level and four at the analysis level. Reliability was determined using split-half procedures and found to be .93 for the total test. The reliabilities for the subtests were: knowledge .94, comprehension .61, and analysis .78.

## Design

A 3 x 2 x 2 factorial design with all factors fixed was used to analyze the data for differences in group means and significant interactions. Analysis of variance procedures were used to detect differences among the means. Significance levels for all hypotheses testing were purposely set a priori at .10 as an acceptable risk of type 1 errors.

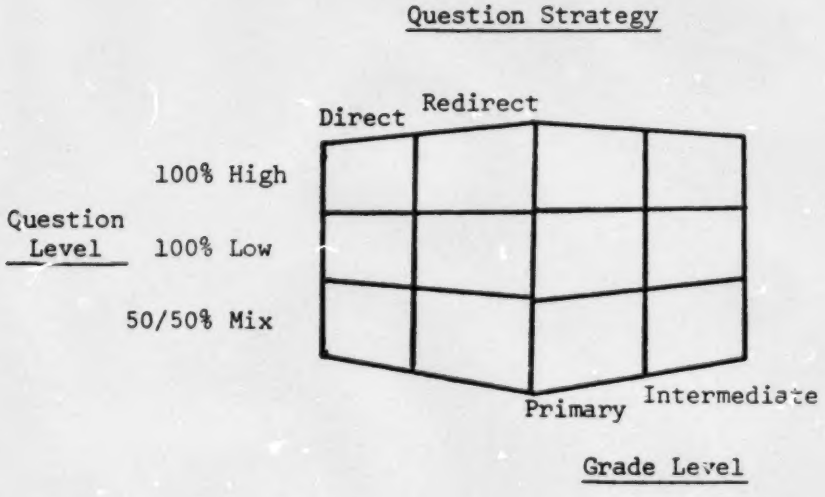


Figure 1. Experimental Design

## Analysis

### Testing the Hypotheses

Hypothesis 1 -- There is no difference in achievement of students due or related to the effects of cognitive level of teachers' questions.

The analysis of variance was unable to distinguish any significant differences among the three treatment means on any of the criterion measures. Hypothesis 1 failed to be rejected and is held tenable.

Hypothesis 2 -- There is no difference in achievement of students due or related to the effects of question redirecting.

Analysis indicated a significant difference related to question redirection on the knowledge subtest. Students who were assigned to teachers using question redirecting techniques scored significantly higher on the knowledge level test than did students assigned to the non-redirecting teaching strategy ($p = .03$)

Differences in scores on the other criterion measures were determined to be chance occurances.

Table 1 provides the results of the analysis of variance.

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Insert Table 1 About Here

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Hypothesis 3 -- There is no significant interaction among treatment, redirection and grade level.

Two interactions on the total achievement test and two on the subtests were found to be non-chance occurances. Significant interactions occured between questioning level and redirection on the overall achievement test. Table 2 provides the results of the analysis of variance. Figures 2 and 3 provide graphs of the two interactions. The significant interactions on the knowledge and comprehension test are provided in Tables 1 and 3. Figures 4 and 5 display the graphed interactions.

## Conclusions and Implications

It can be concluded from these results that redirecting questions is an effective strategy when working with small groups of children. This strategy is most effective with student attainment of knowledge level objectives. The results imply that the potency of redirected questions deminishes as the cognitive demand of questions increases.

The design of this study was not intended to portray the reality of the classroom. The intent was to measure effects of extreme variations in the use of questioning strategies. If differences in the effectiveness of these strategies exist, then chances of finding them are enhanced if extreme examples are examined.

Although the scripted lessons and use of small groups limits the generalizability of these findings, the results provide evidence supporting the effectiveness of redirecting questions.

Table 1

Analysis of Variance Summary Table for the Knowledge Subtest

| Source of Variation | df | Mean Square | F | p |
|---|---|---|---|---|
| Grade level (A) | 1 | 225.64 | 40.72 | .001* |
| Question level (B) | 2 | 7.39 | 1.33 | .26 |
| Redirection (C) | 1 | 24.29 | 4.38 | .03** |
| (A) x (B) | 2 | 14.25 | 2.57 | .08* |
| (A) x (C) | 1 | 8.84 | 1.59 | .20 |
| (B) x (C) | 2 | 1.43 | 0.25 | .77 |
| Error | 142 | 5.54 | | |

*p<.10
**p<.05

Table 2

Analysis of Variance Summary Table for the Total Achievement Test

| Source of Variation | df | Mean Square | F | p |
|---|---|---|---|---|
| Grade level (A) | 1 | 2198.83 | 72.22 | .0001* |
| Question level (B) | 2 | 46.81 | 1.53 | .218 |
| Redirection (C) | 1 | 10.83 | 0.35 | .552 |
| (A) x (B) | 2 | 72.25 | 2.31 | .090* |
| (A) x (C) | 1 | 3.92 | 0.12 | .720 |
| (B) x (C) | 2 | 83.43 | 2.74 | .068* |
| Error | 142 | 30.44 | | |

*p<.10

Table 3

Analysis of Variance Summary Table for the Comprehension Subtest

| Source of Variation | df | Mean Square | F | p |
|---|---|---|---|---|
| Grade level (A) | 1 | 597.88 | 61.45 | .0001* |
| Question level (B) | 2 | 15.26 | 1.56 | .212 |
| Redirection (C) | 1 | 3.76 | 0.38 | .535 |
| (A) x (B) | 2 | 16.83 | 1.73 | .181 |
| (A) x (C) | 1 | 0.23 | 0.02 | .877 |
| (B) x (C) | 2 | 48.16 | 4.95 | .008* |
| Error | 142 | 9.72 | | |

*p<.10

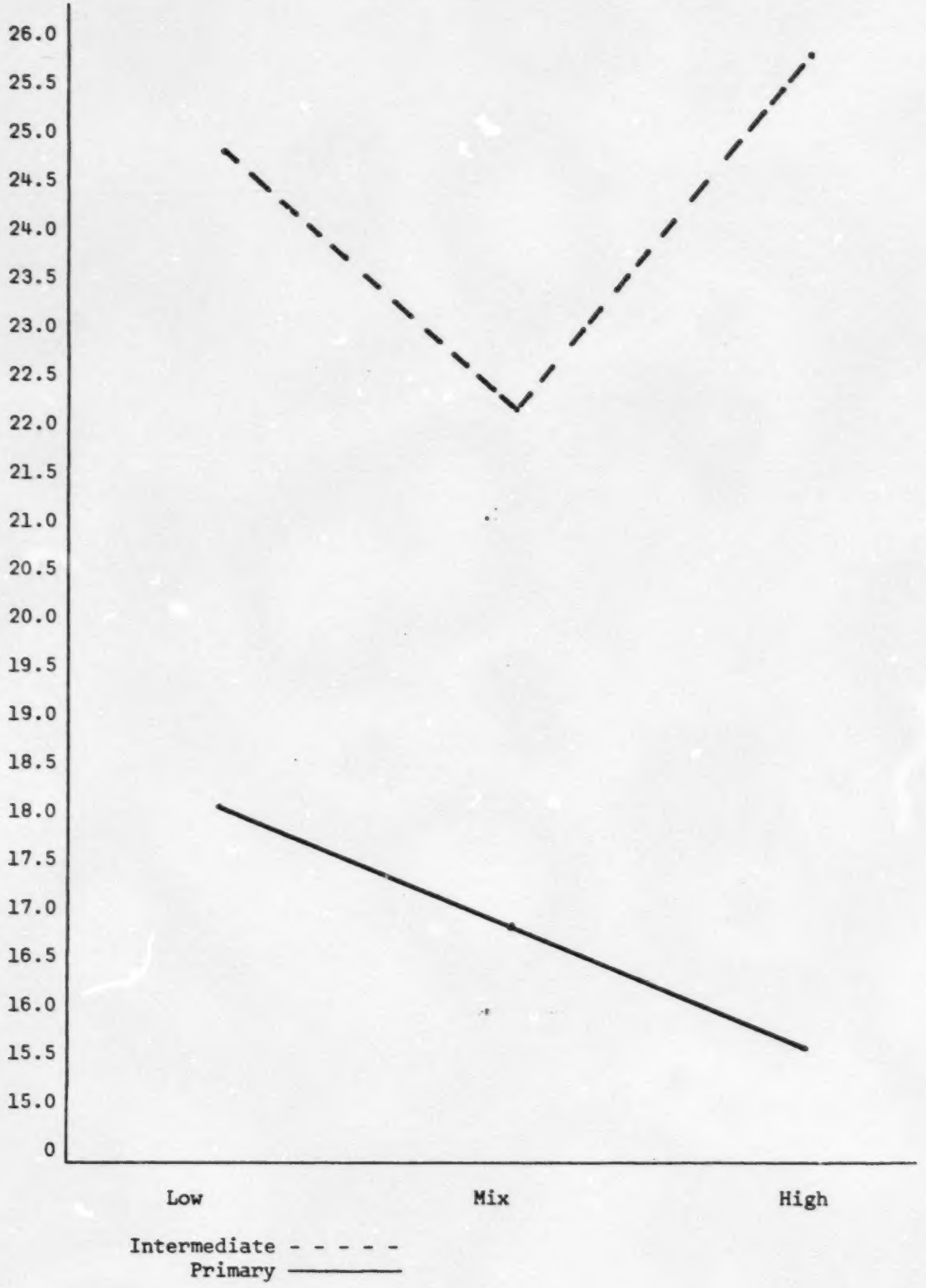


Figure 2. Interaction effects of grade level with teacher's cognitive questioning level on the total achievement test.

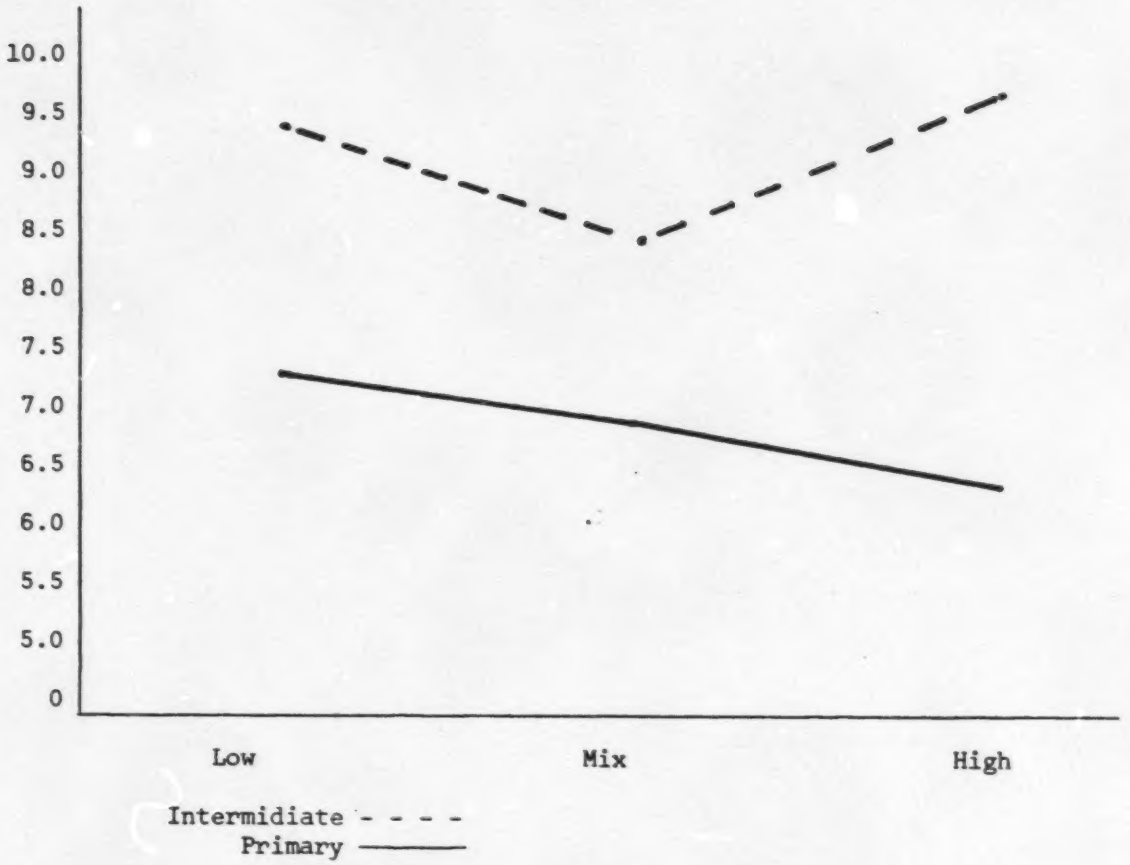


Figure 4. Interaction effects of grade level with teacher's cognitive questioning level on the knowledge subtest.

## REFERENCES


Bloom, B. S. (Ed.) Taxonomy of Educational Objectives. Handbook 1, Cognitive Domain. New York, David McKarp Company, 1956.

Buggey, L. J. A study of the relationship of classroom questions and social studies achievement of second-grade children. (Doctoral dissertation, University of Washington), 1971.

Gall, M. D. The use of questions in teaching. Review of Educational Research. 1970, 40, pp. 707-721.

Popham, W. J., Baker, E., Millman, J., and McNeil, J. D. Teaching Improvement Kit. Los Angeles: Instructional Appraisal Services, 1972.

Ryan, F. L. The effects on social studies achievement of multiple student responding to different levels of questioning. Journal of Experimental Education. 1974, 42, pp. 71-75.

Savage, T. V. A study of the relationship of classroom questions and social studies achievement of fifth-grade children. (Doctoral dissertation, University of Washington), 1972.

Tyler, J. F. A study of the relationship of two methods of question presentation, sex and school location to the social studies achievement of second-grade children. (Doctoral dissertation, University of Washington), 1971.